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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant :	David D. Koester et al.	Appeal No. B/Brief 7/1/03
Serial No.:	09/751,669	
Filed :	December 29, 2000	Group Art Unit: 2652
For :	MACHINING ACTUATOR PERIPHERY TO REDUCE RESONANCE VARIATION	Examiner: Tianjie Chen
Docket No.:	S01.12-0697/STL 9565	

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BRIEF FOR APPELLANT

I HEREBY CERTIFY THAT THIS PAPER IS BEING SENT BY U.S. MAIL, FIRST CLASS, TO THE COMMISSIONER OF PATENTS AND TRADEMARKS, WASHINGTON, D.C. 20231, THIS

24 DAY OF June, 2003

D. D. B

PATENT ATTORNEY

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from a final rejection of the claims in an Office Action dated January 14, 2003.

REAL PARTY IN INTEREST

Seagate Technology LLC, a corporation organized under the laws of the State of Delaware, and having offices at 920 Disc Drive, Scotts Valley, CA 95067, has acquired the entire right, title and interest in and to the invention, the application, and any and all patents to be obtained therefore, as set forth in the Assignment filed with the Patent Application and recorded on Reel 011615/Frame 0445.

RELATED APPEALS AND INTERFERENCES

Applicants are aware of no related appeals or interferences.

STATUS OF THE CLAIMS

Claims 13 and 17-21 are pending in the application and stand rejected based on cited references. Claims 1-12 are withdrawn as being directed to a non-elected invention, and claims 14-16 are canceled.

STATUS OF AMENDMENTS

An Amendment-After-Final was filed March 14, 2003, which was entered.

SUMMARY OF INVENTION

I. BACKGROUND OF THE INVENTION

The present invention relates to reducing resonance vibration of an actuator in a data storage system. (Page 1, lines 10-12).

The mechanical structure of a data storage system, such as a disc drive, is composed of multiple mechanical components that are pieced together to form the final assembly. Each of these components has various resonant modes that if excited by an external energy source will cause the part to physically move (resonate) at the resonance frequencies of oscillation for the component in question. One component that contributes greatly to such resonant vibration is the actuator. If a component is highly undamped, it will tend to oscillate with a minimal external driving energy. This oscillation results in physical motion of the data head, causing off track errors and potential fly height problems. (Page 2, lines 3-14).

Various schemes can be employed to damp the mechanical components and thereby decrease the amplitude of the resonant mode. Many such resonance-reducing techniques make use of information regarding the resonance characteristics of the disc drive mechanical structure. If the resonance characteristics vary greatly from one drive to the next among a production line, the resonance characteristics data used by the resonance-reducing scheme are likely to be inaccurate. Thus, reducing the variance in the resonance characteristics from one drive to the next will increase the accuracy of the resonance-reducing scheme. (Page 2, line 15 to page 3, line 3).

Present-day disc drive actuators are usually manufactured by casting or extrusion processes. The casting

process involves placing a castable substance in a mold or form and allowing it to solidify. Extrusion consists of forcing a semisoft solid material, such as metal, through the orifice of a die to form a continuously formed piece in the desired shape of the actuator. Typically the resulting length of material is then cut into individual longitudinal sections, each corresponding to a single actuator. The placement of each cut thus defines the top of one actuator (on one side of the cut) and the bottom of another actuator (on the other side of the cut). Thus, the cross-sectional shape of the actuators, as viewed from above or below, is defined by the extrusion process. (Page 3, lines 4-13).

The processes of casting and extruding actuators inherently have profile tolerances that result in significant variation in arm resonance from actuator to actuator. (Page 3, lines 14-19).

II. <u>THE PRESENT INVENTION</u>

FIG. 1 (Exhibit A) is a top view of a disc drive 100 in accordance with one embodiment of the present invention. Disc drive 100 includes a disc pack 106 mounted for rotation about a spindle 109. An actuator 116 is moveable relative to disc pack 106 about pivot shaft 120. Actuator 116 includes an E-block assembly 117, which includes a plurality of actuator arms 114. Each actuator arm 114 carries one or more flexure arms 112, which supports a data head 110 for reading information from and writing information to one of the discs 106. (Page 5, line 14 to page 6, line 17).

Figures 2 and 3 (Exhibit A) are perspective views of an actuator 116 according to an illustrative embodiment of the present invention. Actuator 116 includes actuator body 124 having a pivot bore 126, which receives pivot shaft 120 (Figure 1). E-block 117 extends outwardly from actuator body 124 and includes multiple actuator arms 114. Each actuator arm 114 is adapted to

couple to one or more flexure arms 112 (Figure 1). On the opposite side of the actuator body 124 from E-block 117 is a voice coil support 128, which supports a coil (not shown) that lies between a pair of permanent magnets, one above and one below. When drive current is applied to the coil, actuator 116 pivots about pivot shaft 120, thereby positioning data heads 110 (supported by arms 114) relative to disc pack 106. (page 6, line 24 to page 7, line 16).

For the purpose of the present application, surfaces 130, 132 and 134 (Figure 2), along with all other surfaces so oriented, are referred to as top surfaces, as these surfaces face upwardly when the drive 100 is disposed horizontally. Correspondingly, surfaces 136, 138 and 140 (Figure 3), as well as all other surfaces facing in the same direction, are referred to as bottom surfaces. All external surfaces of actuator 116 that are not substantially parallel to top surfaces 130, 132 and 134 and bottom surfaces 136, 138 and 140 are thus referred to as peripheral surfaces. In Figures 2 and 3, such peripheral surfaces include surfaces 142, 144, 146, 148, 150, 152, 154, 156, 158 and 160. (Page 6, line 17 to page 7, line4).

FIG. 4 (Exhibit A) is a flow chart representing a method of manufacturing a disc drive actuator 116 according to an illustrative embodiment of the present invention. At step 400, the actuator 116 is manufactured by extruding a length of solid material or casting a material in a mold such that a peripheral surface (142, 144, 146, 148, 150, 152, 154, 156, 158 or 160 in Figures 2 and 3) has a profile dimension that is greater than a desired final profile dimension. (Page 8, lines 5-18).

The length of material is then cut into longitudinal sections, at step 401, such that each longitudinal section corresponds to a single actuator 116. The length of extruded material is illustratively also further cut or machined, at step 402, to achieve the desired shape of the actuator. After

actuator 116 is produced by extrusion or casting, bores through actuator 116 are drilled, at step 403. (Page 8, line 19 to page 9, line 2).

At step 404, the peripheral surface (surfaces 142, 144, 146, 148, 150, 152, 154, 156, 158 and 160 in Figures 2 and 3) of the actuator is machined to a desired final profile dimension. In one embodiment, substantially the entire periphery of actuator 116 is machined to the desired final profile dimension. The profile dimension is defined as the dimension perpendicular to the surface when viewed from above or below. (Page 9, lines 3-15).

Machining the periphery allows the surface to be manufactured to a lower tolerance than if the surface is simply extruded or molded without machining the surface. The precise profile dimension of the surface can be achieved with greater accuracy and greater certainty. Thus, when manufacturing a group of similar actuators, there will be less variance in the profile dimensions from one actuator to the next. This results in a reduced degree of variance in the resonance characteristics from one actuator to the next. (Page 9, line 16 to page 10, line 3).

FIG. 5 (Exhibit A) is a top view of actuator 116. Dashed line 500 shows the profile dimension of the peripheral surface after the extrusion or casting. Solid line 502 shows the desired profile of the peripheral surface. Profile dimension 502 is achieved by machining the surface. (Page 10, lines 4-23).

According to an illustrative embodiment of the present invention, a machined surface is achieved by advancing machining tool 504 about the periphery of actuator 116 while maintaining contact between the machining tool and the peripheral surface of the actuator. Machining tool 504 is advanced about the periphery of the actuator along a predetermined path designated by dashed line 506. In one embodiment, machining tool 504 is an end mill, which has a rotating shank with cutting teeth at the end and

spiral blades on the peripheral surface. (Page 10, line 24 to page 11, line 17).

ISSUES

Whether claim 13 meets the requirements of novelty under 35 U.S.C. § 102(e), and is thus patentable over Prater et al. U.S. Patent No. 6,151,198 (Exhibit C).

Whether claims 17-18 meet the requirements of non-obviousness under 35 U.S.C. § 103(a), and are thus patentable over Prater et al. (Exhibit C) in view of Brar at al. U.S. Patent 5,156,919 (Exhibit D).

Whether claims 19 and 21 meet the requirements of non-obviousness under 35 U.S.C. § 103(a), and are thus patentable over Prater et al. (Exhibit C) in view of Brar at al. (Exhibit D) and Nikolovski U.S. Patent No. 6.269,700 (Exhibit E).

Whether claim 20 meets the requirements of non-obviousness under 35 U.S.C. § 103(a), and is thus patentable over Prater et al. (Exhibit C) in view of Brar at al. (Exhibit D) and Nikolovski (Exhibit E).

GROUPING OF CLAIMS

Claims 13 and 17-21 (Appendix 1) are separately patentable in the following groups:

Group I: Claim 13;
Group II: Claims 17-18;
Group III: Claims 19 and 21; and
Group III: Claim 20.

ARGUMENT

I. THE REJECTION OF CLAIM 13 (GROUP I) SHOULD BE REVERSED

Claim 13 was rejected under §102(e) as being anticipated by Prater et al., U.S. Patent No. 6,151,198 (Exhibit C).

Claim 13 is directed to a disc drive comprising "an actuator with a machined external peripheral surface extending along an entire periphery of the actuator and comprising a

desired profile dimension entirely defined by the machined external peripheral surface."

A. **The Office Action Mischaracterizes Prater et al.**

With regard to claim 13, the Office Action inaccurately states that, "Prater et al shows an actuator 11 (Fig, 4) to be used in a disc drive, with machined external peripheral surface extending along an entire periphery of the actuator and including a desired profile dimension entirely defined by the machined external peripheral surface (Column 3, lines 65-67)."

Prater et al. does not disclose an actuator with a machined external peripheral surface extending along an entire periphery of the actuator or a desired profile dimension entirely defined by the machined external peripheral surface, as recited in claim 13.

The citation referred to by the Examiner simply states that the actuator has an arm, "capable of being machined to include desired features." This statement simply defines a property of the material -- that is capable of being machined. Also, reference to "desired features" implies individual elements on the actuator not an entire periphery.

Nowhere does Prater et al. teach or suggest that the entire periphery of the actuator comprises a machined surface that entirely defines a desired profile dimension. Therefore, the above-statement in the Office Action regarding the Prater et al. disclosure is not supported by the reference and is inaccurate.

2. "Machined External Surface" Is A Structural Element, Not A Product-By-Process Element.

Claim 13 requires the actuator to have a "machined external peripheral surface." As described below, this phrase is a structural element within the context of the claim.

The Office Action suggests that the term "machined" is a process limitation. Therefore, no weight was given to this term when determining patentability of the claim.

The term "machined" is an adjective that modifies the noun "surface". As explained in the enclosed Declaration of David D. Koester (Exhibit B), a "machined external peripheral surface" can clearly be identified by inspection of the surface and its properties. For example, a visual inspection would easily distinguish a cast or extruded surface from a machined surface. Mr. Koester explains that, "a machined surface has a regular pattern of micro-grooves or scratches that are associated with the rotary or linear movement of the cutting features of the machining tool." "A cast or extruded surface has a dull, smooth surface finish that is substantially devoid of similar patterns of micro-grooves or scratches." Based on these properties, Mr. Koester concludes that the adjective "machined" in the phrase, "machined external peripheral surface" therefore refers to a definite structural element of the surface, which is easily identifiable by a person of ordinary skill in the art through inspection of the surface.

This phrase therefore adds a definite structural limitation to claim 1 that bears patentable weight within the claim.

Since Prater et al. do not teach or suggest an actuator comprising a machined external peripheral surface that extends along an entire periphery of the actuator and comprising a desired profile dimension entirely defined by the machined external peripheral surface, Applicants respectfully request that the rejection of claim 13 under §102(e) be reversed.

II. <u>THE REJECTION OF CLAIMS 17 AND 18 (GROUP II) UNDER §103(a) SHOULD BE REVERSED</u>

Claims 17 and 18 were rejected under §103(a) as being unpatentable over Prater et al. (Exhibit C) in view of Brar et al., U.S. Patent No. 5,156,919 (Exhibit D).

Claims 17 and 18 are dependent claims that depend from independent claim 13. Claims 17 and 18 specify tolerances of the

machined external peripheral surface relative to the desired profile dimension.

The Office Action acknowledges that Prater et al. is silent on the tolerance of the dimension of the surface but suggests this tolerance would be obvious in view of Brar et al. However, as discussed above, Prater et al. fail to teach or suggest a machined external surface extending along an entire periphery of an actuator. Therefore even if the teachings of Brar et al. were combined with those of Prater et al., the resulting combination would still fail to teach or suggest all of the elements of dependent claims 17 and 18, including the elements of independent claim 13. Accordingly, Applicants respectfully request that the rejection of claims 17 and 18 under §103(a) be reversed.

III. REJECTION OF CLAIMS 19 AND 21 (GROUP III) UNDER §103(a) SHOULD BE REVERSED

Claims 19-21 were rejected under §103(a) as being unpatentable over Prater et al. in view of Brar et al. and Nikolovski, U.S. Patent No. 6,269,700.

Claim 19 is an independent claim including actuator means having a machined external peripheral surface with a desired profile dimension. The desired profile dimension is "defined for limiting variations in resonance characteristics of the actuator means." Claim 21 provides a tolerance of 0.005 inches or less.

The Office Action acknowledges that neither Prater et al. nor Brar et al. teach or suggest an actuator having a machined external peripheral surface with a profile dimension that is defined for limiting variations in resonance characteristics of the actuator.

The Office Action suggests that this would be obvious in view of Nikolovski, which suggests that in an ultrasonic emitter/receiver having a focusing spike, resonant frequencies are determined by the dimensions of the spike and the speed of the

ultrasonic waves in the spike. Nikolovski does not suggest an actuator in a disc drive could have a machined peripheral surface with a dimension that is defined for limiting resonance variations in the actuator.

The Court of Appeals for the Federal Circuit states that, "[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." In re Fritch, 972 F.2d 1260, 1266 n.14 (Fed. Cir. 1992, citing In re Gordon, 733 F.2d 900, 902 (Fed. Cir. 1984).

In this case, neither reference teaches or suggests the desirability of such a modification. Further, even if the teaching of Nikolovski were combined with that of Prater and Brar, the resulting combination would still fail to teach or suggest the invention recited in claim 19.

Accordingly, the Applicants respectfully request that the rejection of claims 19 and 21 under §103(a) be reversed.

IV. REJECTION OF CLAIM 20 (GROUP IV) UNDER §103(a) SHOULD BE REVERSED

Claim 20 requires the machined external peripheral surface to extend along an entire periphery of the actuator means such that the desired profile dimension is defined entirely by the machined peripheral surface.

Within the context of claim 19, the desired profile dimension is therefore defined entirely by the machined peripheral surface for limiting variations in resonance characteristics.

Contrary to the statement in the Office action, Prater et al. do not teach an actuator having a machined external peripheral surface extending along an entire periphery of the actuator.

None of the references teach or either separately or in combination suggest an actuator in which not only the machined external peripheral surface extends along an entire periphery

along the actuator, but also the profile dimension is defined for limiting variations in resonance characteristics.

Accordingly, the Applicants respectfully request that the rejection of claim 20 under §103(a) be reversed.

CONCLUSION

Applicants respectfully request that the Board reverse the Examiner and find that claims 13 and 17-21 are in condition for allowance.

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APPENDIX 1

13. (Amended) A disc drive comprising an actuator with a machined external peripheral surface extending along an entire periphery of the actuator and comprising a desired profile dimension entirely defined by the machined external peripheral surface.

17. (Amended) The disc drive of claim 13 wherein the machined external peripheral surface of the actuator has a tolerance of less than 0.010 inches relative to the desired profile dimension.

18. (Amended) The disc drive of claim 13 wherein the machined external peripheral surface of the actuator has a tolerance of 0.005 inches or less relative to the desired profile dimension.

19. (Amended) A disc drive comprising:

a disc rotatable about a central axis; and

actuator means for supporting and actuating a transducer relative to the disc and having a machined external peripheral surface with a desired profile dimension, which is within a tolerance of less than 0.010 inches relative to the desired profile dimension, that is defined for limiting variations in resonance characteristics of the actuator means.

20. The disc drive of claim 19 wherein the machined external peripheral surface extends along an entire

periphery of the actuator means such that the desired profile dimension is defined entirely by the machined peripheral surface.

21. The disc drive of claim 19 wherein the machined external peripheral surface of the actuator has a tolerance of 0.005 inches or less relative to the desired profile dimension.

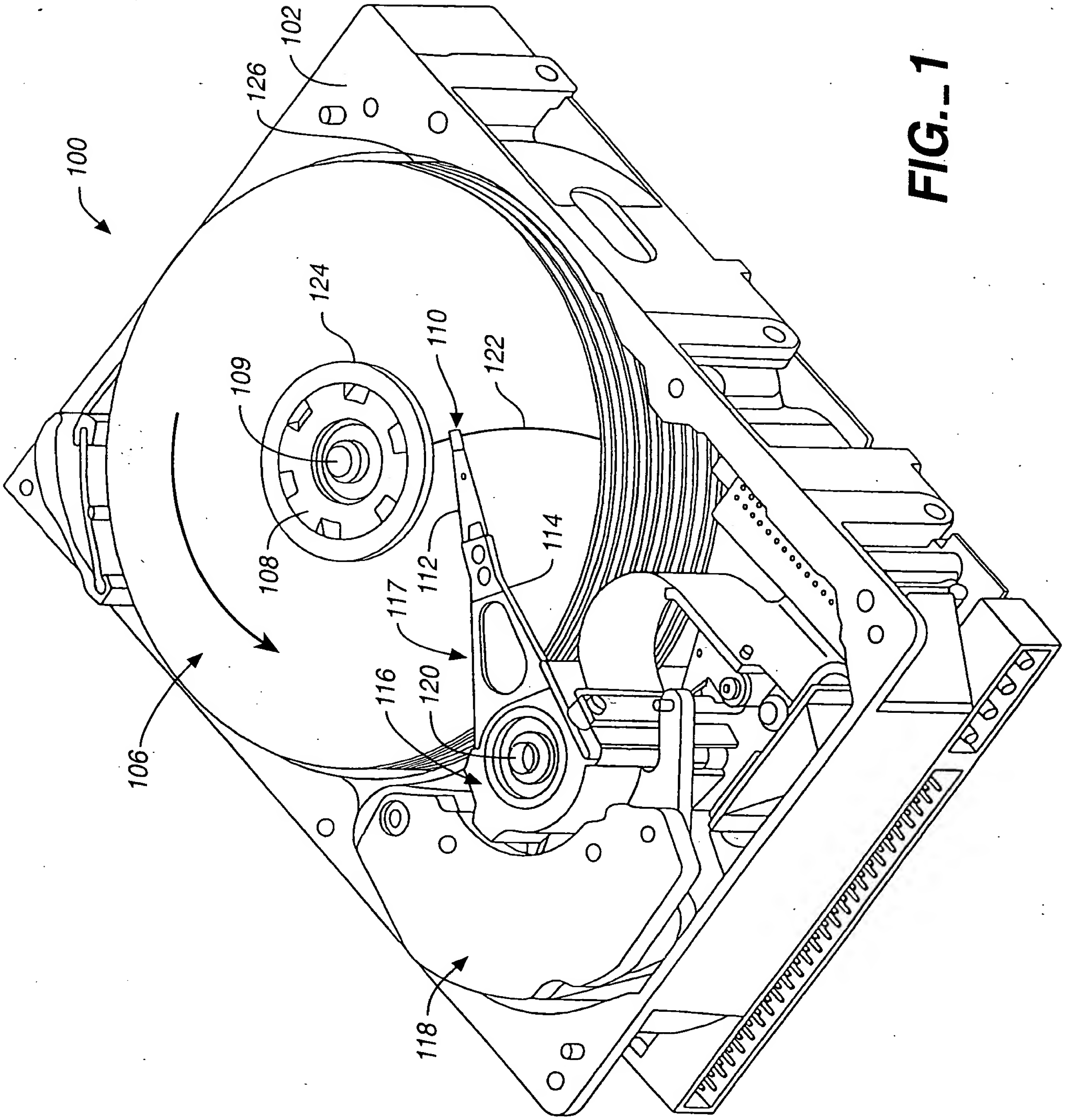

FIG._1

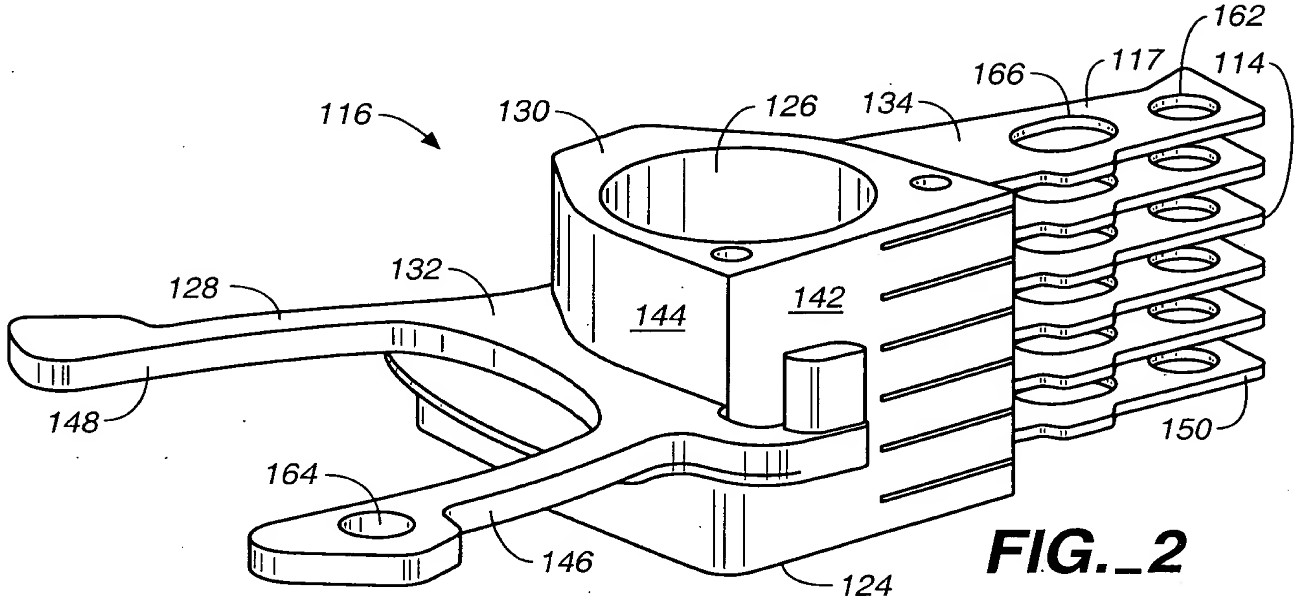
162
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FIG._2

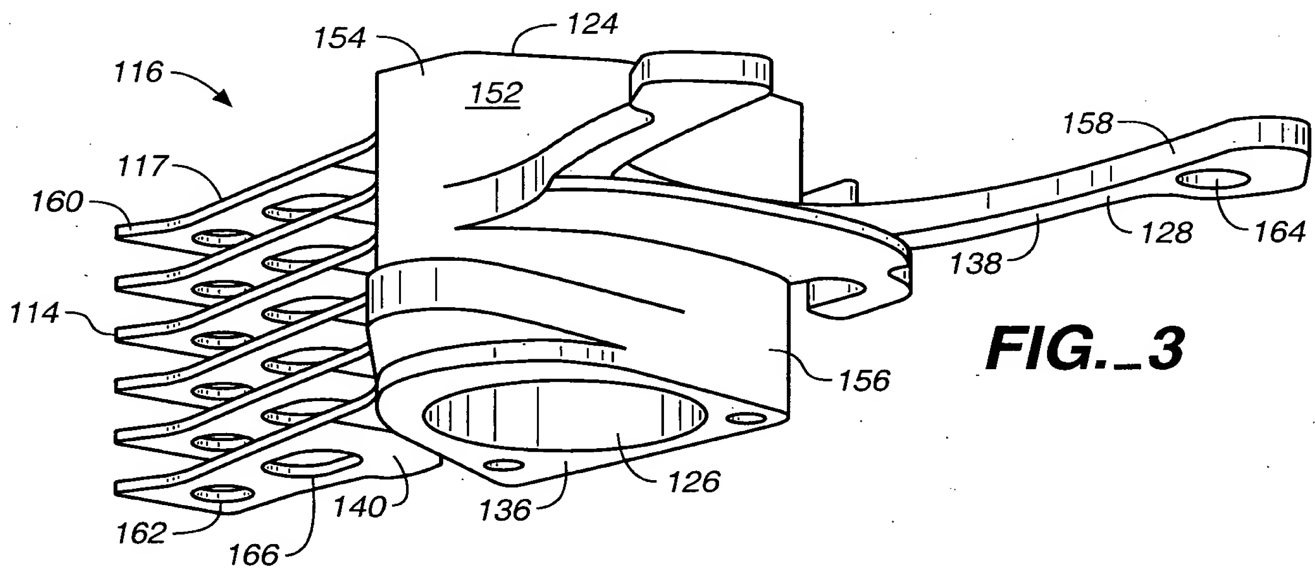
124
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FIG._3

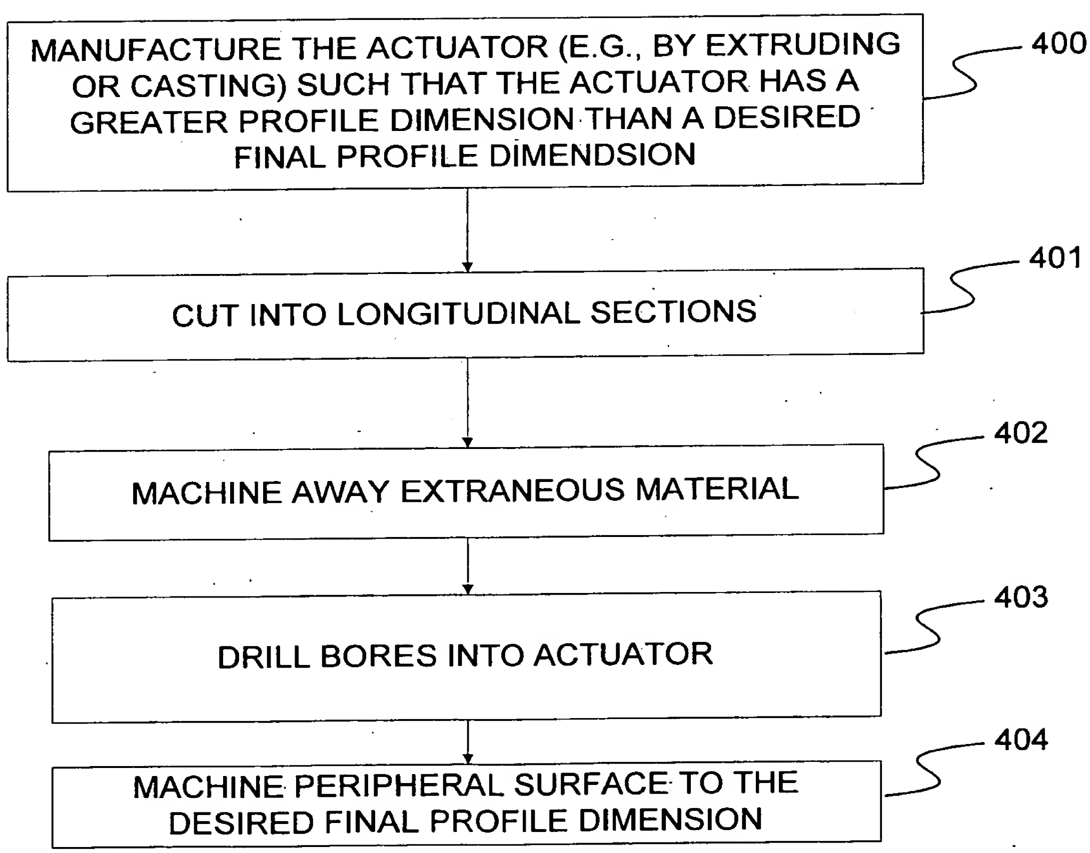
MANUFACTURE THE ACTUATOR (E.G., BY EXTRUDING OR CASTING) SUCH THAT THE ACTUATOR HAS A GREATER PROFILE DIMENSION THAN A DESIRED FINAL PROFILE DIMENDSION
400
CUT INTO LONGITUDINAL SECTIONS
401
MACHINE AWAY EXTRANEOUS MATERIAL
402
DRILL BORES INTO ACTUATOR
403
MACHINE PERIPHERAL SURFACE TO THE DESIRED FINAL PROFILE DIMENSION
404

FIG._4

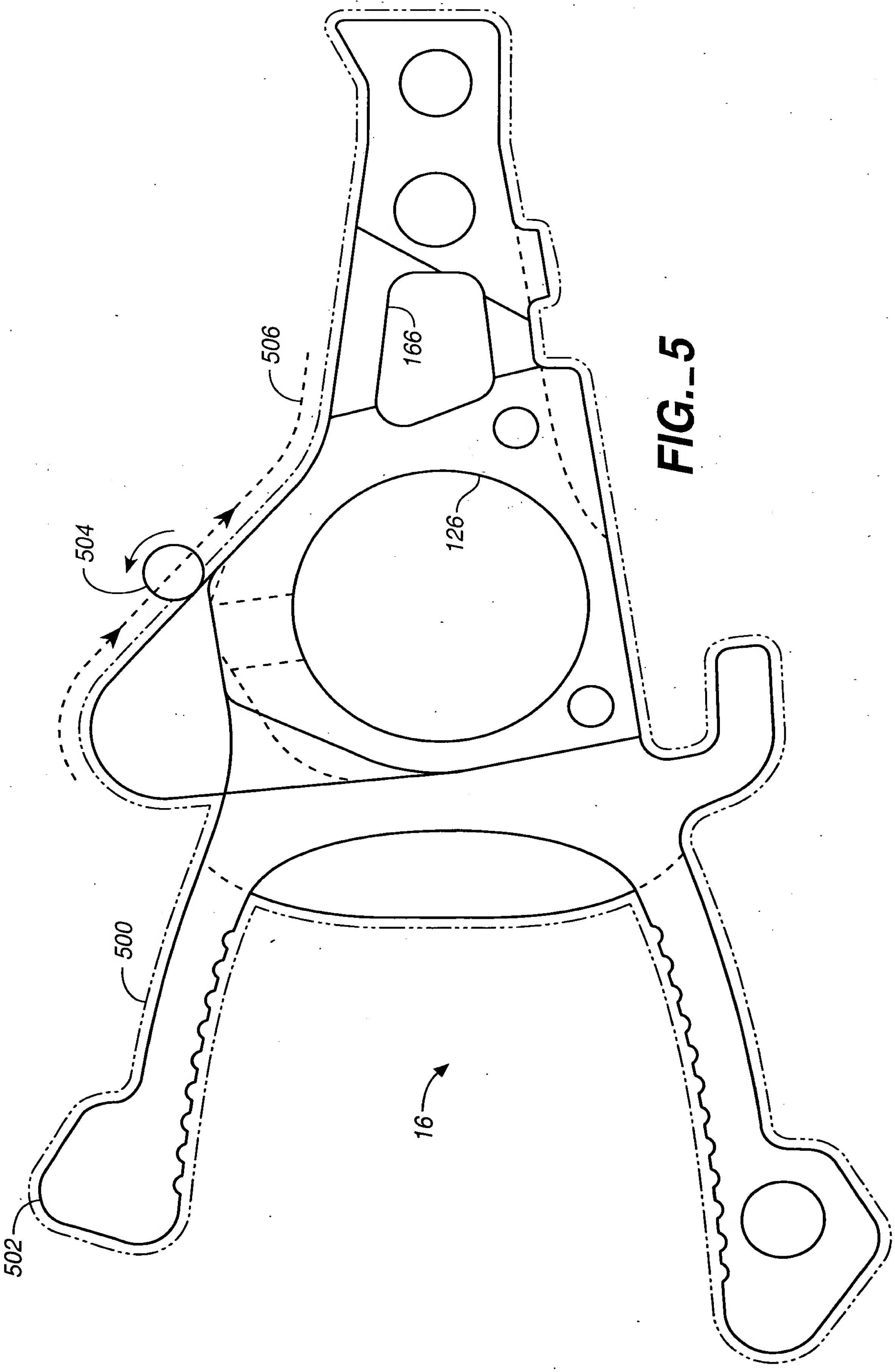

FIG._5

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor :	David D. Koester et al.	
Appln. No.:	09/751,669	
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For :	MACHINING ACTUATOR PERIPHERY TO REDUCE RESONANCE VARIATION	Examiner: Tianjie Chen
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DECLARATION OF DAVID D. KOESTER

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I HEREBY CERTIFY THAT THIS PAPER IS BEING SENT BY U.S. MAIL, FIRST CLASS, TO THE COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450, THIS

24 DAY OF June, 2003

David D. B[signature]
PATENT ATTORNEY

Sir:

1. I, David D. Koester, hereby declare as follows:

2. I am one of the inventors in the above-identified patent application.

3. I received a master's degree in mechanical engineering from the University of Minnesota, Minneapolis, MN.

4. I have been employed at Seagate Technology, LLC for 16 years as a mechanical engineer, and I am currently a mechanical engineering manager of a group responsible for the overall drive assembly of one of Seagate's products. This assembly includes an actuator.

5. Through my work at Seagate, I have become familiar with various mechanical surfaces and surface finishes, such as machined, cast and extruded surfaces.

EXHIBIT

B

6. A machined surface has a surface finish, which can clearly be identified by inspection of the surface and its properties. For example, a visual inspection would easily distinguish a cast or extruded surface from a machined surface.

7. A machined surface has a regular pattern of micro-grooves or scratches that are associated with the rotary or linear movement of the cutting features of the machining tool. A cast or extruded surface has a dull, smooth surface finish that is substantially devoid of similar patterns of micro-grooves or scratches.

8. The adjective "machined" in the phrase, "machined external peripheral surface" therefore refers to a definite structural element of the surface, which is easily identifiable by a person of ordinary skill in the art through inspection of the surface.

9. I declare that all statements made herein that are of my own knowledge are true and that all statements that are made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the above-application or any patent issued thereon.

David D. Koester

David D. Koester

Date: 6-19-03